

The Beauty of Prostheses:

Designing for Female Amputees

by

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B.S. Mechanical Engineering
University of New Mexico, 2011

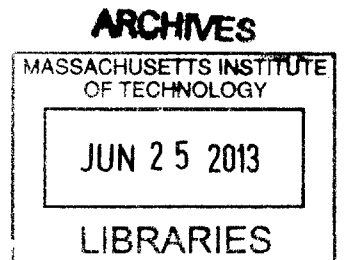
SUBMITTED TO THE DEPARTMENT OF MECHANICAL ENGINEERING IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN MECHANICAL ENGINEERING
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2013

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Submitted to the Department of Mechanical Engineering on
May 17, 2013 in Partial Fulfillment of the Requirements for the Degree of
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ABSTRACT

For a person living with limb loss, obtaining a prosthesis may help the amputee regain, and sometimes even surpass, the capabilities and aesthetics of the natural human body. A prosthesis is carefully designed to provide optimal functionality to assist the amputee in returning back to her normal daily activities as much and as independently as is possible. However, when an amputee wears her prosthesis, the prosthesis also becomes a part of her body image and feminine identity. She requires a prosthesis that aligns aesthetically with her body image just as much as she requires comfort and functionality. In designing for a female amputee, the focus needs to shift from a purely functional or aesthetic perspective to one that sees the whole woman that is the female amputee and works to design her the right tools that will help her reach her goals.

The current prosthesis design process does not account for the importance of latent needs related to the feminine identity of female amputees. These unaddressed needs can contribute to issues of poor body image and lower levels of life satisfaction with prosthetic devices. Embracing latent, aesthetic needs early in the prosthesis design process can help lead prosthetists to more informed design decisions and increased prosthesis user satisfaction. In this thesis, use case diagrams are developed to define the scope of a female's interactions with the items in her feminine wardrobe, as clothes are a crucial part of expressing one's feminine identity. The diagrams allow the identification of areas of identity that will be most affected as a result of a particular amputation. Using the three use case diagrams in this thesis as inspiration, prosthetists can work with amputees to develop requirements that address both explicit and latent needs, and design prostheses that are more appropriate for the female gender.

Thesis Supervisor: David R. Wallace
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Acknowledgements

I am so very grateful to have had this wonderful opportunity to give back to the world in a way that spoke to my heart.

Thank you to my advisor, David Wallace, for your guidance and belief in me.

Thank you to my loved ones, my heroes, my friends, and my mentors for your encouragement, your kind words, your shared experiences, and your love. You all inspire and enlighten me in the most amazing ways.

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Chapter 1

Inspiration

A prosthetic limb doesn't represent the need to replace loss anymore. It can stand as a symbol where the wearer has the power to create whatever it is they want to create in that space, so people that society once considered to be disabled can now become the architects of their own identities—and indeed continues to change those identities—by designing their bodies from a place of empowerment.

- Aimee Mullins [1]

Prostheses are artificial devices developed to replace the form and function of missing body parts. These devices have the ability to significantly impact the lives of amputees by giving them the opportunity to return to as much of their normal daily activities as independently as possible. Through prostheses, amputees may regain—and at times, surpass—the function, form, or both of a missing body part. Advancements in prosthesis technology have been so successful that there have been calls for disqualification of amputees due to unfair advantage in the Olympic Games, the most prestigious sports competition in the world¹. Prosthesis use helps amputees regain physical mastery and freedom, and it can lead to a greater acceptance of the physical impairment, feelings of social equality, enhanced independence, and a sense of security [2].

¹In 2008, the International Association of Athletics Federations' (IAAF) made a decision to ban double amputee Oscar Pistorius from competing against able-bodied athletes. They had conducted a study of Pistorius' J-shaped, carbon-fiber prostheses and concluded the prostheses provided him with an unfair advantage. However, flaws were revealed in the IAAF's scientific study, and the Court of Arbitration for Sports upheld the appeal Pistorius filed against the IAAF's decision. Pistorius went on to compete in the 2012 Summer Olympics, competing in the 400 meter men's semifinal as well as the 4x400 meter relay final [3].

Modern prostheses have revolutionized what it means to be a female amputee. This is especially true for Aimee Mullins, an American actress, model, and athlete. Mullins is a double amputee whose presence in the public eye has emphasized the meaning of empowerment and perseverance. Born without shinbones as the result of fibular hemimelia, she had both legs amputated below the knee as an infant. Over the years, she became the first amputee to compete on an NCAA track team and set three world records in the 1996 Paralympics. Mullins is also immersed in the world of fashion and beauty—she has strutted down the catwalks of celebrated designers, been named to *People* magazine's 50 Most Beautiful list, and is a spokesperson for L'Oreal, the world's leader in cosmetics and beauty [4]. She is the proud owner of 12 different prosthetic legs, some for athletic purposes and others for fashion purposes. Mullins is a great example of how prostheses and beauty are connected—being an amputee does not make a woman any less feminine. She is the same woman with the same values and ideals, the same taste in fashion, and the same desire to reflect her inner beauty externally.

Because research and development in prostheses has been stimulated largely by war and funded by groups like the United States' Department of Veterans Affairs, traditional prostheses available are designed primarily to restore motor function while aesthetic appeal remains an afterthought [5] [6]. Perhaps due to most males' fascination with superheroes and superpowers, there has been a growing trend towards futuristic-looking prostheses:

We want the bionic limb to have a humanlike shape but we don't want the bionic leg to look human. We want it to look like a beautiful machine, to express machine beauty as opposed to human beauty—and the reason is, we want the user to pull a black sock over their bionic limb and have their limb appear to be

fully biological and then the very next evening, go to a fancy party where they pull that sock off and they expose the fact that part of their body is bionic.

– Hugh Herr [7]

Naturally, males and females have different ideas of what is beautiful. In the eyes of a female, a machine may look fascinating but not necessarily beautiful. Therefore, even though a bionic limb may be exactly what a male amputee seeks, some female amputees may not be as satisfied with that same limb.

This is not to say that attempts have not been made to incorporate femininity into prostheses—prosthetists have worked to provide female amputees with prostheses that are appropriately female-gendered. Unfortunately, having a female-gendered prosthesis does not guarantee a higher level of satisfaction; issues including lack of cosmesis, a term referring to the visual appearance of a prosthesis, and lack of a seamless integration into the female amputee's normal daily activities remain significant factors of the dissatisfaction of female amputees [5, 8].

Thesis Overview

Embracing femininity early in the design process of prostheses can help identify specific latent needs of female amputees that have the potential to affect the success of female-gendered prostheses and thus the amputee's overall well-being.

For this thesis, we identify the role of femininity in prostheses and explore ways in which the current prosthesis designs interfere. With the insight gained, we develop use cases to aide prosthetists identify areas of priority when designing prostheses for female amputees. Possible latent needs exists in these area, and early consideration

of these needs in the design process can lead to more informed design decisions and improved female-gendered prostheses.

This research aims to lay the foundation for the successful design of prostheses for female amputees. Though some prosthetists have begun designing female-gendered prostheses, there still exists a disconnect between most amputees and prosthetists about what determines a successful prosthesis. Traditionally, a duality has existed between aesthetics and functionality: prostheses should either be made for appearance, largely an imitation of the human body with constrained functionality, or for optimized functionality above all other considerations, the way tools are made [9]. However, when an amputee chooses to wear a prosthesis, it becomes part of the amputee's body image and her very identity—the direction of design then evolves from a decision between looks and functionality to an understanding of who the amputee is, how she desires to live her life, and how her prosthesis can be designed to support her lifestyle. Through the exploration of the importance of femininity in the female amputee's identity, an analysis of the current need identification process, the construction of use case diagrams to identify possible areas of female amputee latent needs, we gain a clearer understanding of how the prosthetics field can be revolutionized to empower female amputees by providing them more personalized and comfortable solutions that are meaningful and improve their overall well-being.

- **Chapter 2** explores the psychological aspect of female prosthesis use and the importance of femininity in a woman's identity.
- **Chapter 3** presents the current evaluation process conducted by prosthetists and explains why it is not enough for female amputees.
- **Chapter 4** discusses the importance of identifying feminine latent needs early in the prosthesis design process. This chapter also presents use case

diagrams that identify areas of common latent needs of female amputees and discusses how this new approach towards needs identification can help prosthetists improve female-gendered prosthesis designs.

- **Chapter 5** presents insight gained during this research that can be applied in future work regarding prosthesis design for female amputees.

Chapter 2

Life Post-Amputation

Limb amputation can occur for many reasons—as the result of a trauma, tumor, disease, or is congenital. Ideally, a dedicated team of healthcare professionals works with the amputee throughout the duration of the recovery process to address continuous and specific needs and to develop solutions that will allow the amputee to regain a comfortable quality of living. The size and skillset of this clinic team change depending on the amputee's needs and resources, and a well-rounded team consists of the physician, prosthetist, nurse, physical therapist, occupational therapist, social worker, and vocational counselor [5]. Regardless of the cause of amputation, it is important to provide the amputee with the proper support and equipment required to resume the life that existed pre-amputation, for it should be only slightly if no different from the life that exists post-amputation.

In addition to the recovery process, the amputee must learn to cope with limb loss and confront different physical and psychosocial adjustments, such as changes in lifestyle, employment status, pain, and body image [10]. Because this research seeks to address femininity in prosthesis design, we will focus solely on the issue of body image.

Body Image

Our body image is our internal concept of how we appear externally [11]. Body image changes are a critical issue in the adjustment to limb loss and prosthesis acceptance—how we feel about the way we look is more important to our self-esteem

than our actual appearance [2]. Poor body image post-amputation puts the amputee at risk for negative outcomes such as increased depression and decreased life satisfaction, quality of life, and activity levels. It is important to most amputees to have an optimal prosthesis, as it is the central part of their post-amputation body image adjustment. The prosthesis is often viewed as an extension of the body, and dissatisfaction with either the functional or aesthetic aspect of the prosthesis could lead to adjustment difficulties [12].

Body image is generally considered to be an important component of identity development [13]. Beginning in the early years of our childhood, we develop body awareness as a result of our interactions with the environment around us, gathering cultural meanings assigned to our bodies in different settings and forming body views through taking in others' perceptions of their looks and abilities [14]. From this we develop our own body image, a basis for our identity in our interactions with others in our community.

The Feminine Identity

Along with focusing on a healthy recovery following limb loss, most female amputees are concerned with issues of body image, primarily with maintaining the feminine identity they have constructed throughout the years. Concerns about different aspects of prosthesis use between males and females show that body image and identity are a higher priority for females. While male amputees tend to focus on the functionality of their prostheses, many female amputees are concerned with feminine attractiveness [15].

To a female amputee, the gendered nature of prosthesis use is of personal significance, perhaps due to societies' pronounced emphasis on the appearance of females [15]. With a global apparel and cosmetics industry that boasts revenues in the billions [16, 17], the prominence of personal aesthetics in our society is undeniable. Little things like the ability to continue—and feel comfortable—wearing feminine clothes such as skirts and high heels and to have long painted nails are important to female amputees in sustaining a sense of femininity [18].

Craig D. Murray's "Gender, Sexuality and Prosthesis Use: Implications for Rehabilitation" discusses a research project conducted to examine the feeling and experience of prosthesis use, of which the design of a prosthetic was found to have the potential of creating problems for gendered identities. The findings of the project confirmed that femininity is highly implicated in the experience of prosthesis use for female amputees. Female participants particularly expressed disappointment when their prosthesis use required them to compromise what could be worn, as clothes emerged in the study to be of importance in a female's expression of her femininity. A 73-year-old woman who has had a below-the-knee amputation for 62 years complained that while she has some very lovely suits, her prosthesis limits her to one heel height. This is problematic because she is only five feet tall and requires high heels to feel comfortable wearing a nice two-piece; she shares that she would have loved to have been able to do that. Unfortunately, it was a sacrifice she had to make because her prosthesis was not designed properly for her. Another woman, 25 years of age, belonged to a group of females in the study who perceived prosthesis use as not suitable for females, especially upper-limb prostheses. Though she acknowledged that using a prosthetic arm would make it easier for her to go about her normal daily activities in many respects, she found a problem with wearing a hook and admitted her reason for non-use was largely cosmetic [8]. Had her prosthetic arm been designed

with that in mind, not only would she find much more use for it in her everyday life, but she would have had a prosthesis she was proud to wear, leading to a more satisfying prosthesis use experience.

Beauty and the Prosthesis

In order to better understand a female amputee's perspective on the importance of femininity in prostheses, we will look to Aimee Mullins, a public personality and double amputee whose seemingly seamless integration of beauty and functionality should serve as an inspiration to the feminine prosthesis movement. A proud owner of 12 pairs of prosthetic legs, including Cheetah legs used for athletic purposes, an everyday pair with springs and shock absorbers, and decorative pairs for photo shoots, Mullins uses them both as functional devices and as fashion accessories. She even has a pair of natural-looking legs that include freckles and hair follicles. She has four pairs of cosmetic legs made of silicone made for different heel heights so that her shoe options are not limited [1].



Figure 1: Aimee Mullins Prosthetic Leg Collection

A female amputee should not have to sacrifice her desire to participate in the world of fashion and beauty as a result of limb loss. She should also not have to worry about a prosthesis that she is uncomfortable with or ashamed of wearing. Her prosthesis is to be another one of her lovely accessories, “an object of healthy curiosity, a work of art” [9]—an expression of who she is and a reflection of her strength, perseverance, courage, and beauty. Her prosthesis, therefore, requires a special kind of attention—one that takes into account not only the functionality that she requires but also the different feminine characteristics that she identifies with, and provides an aesthetic form that aligns with her unique body image.

Chapter 3

Current Evaluation Process

When an amputee decides that she wants a prosthesis, she begins the process of obtaining one by meeting with a prosthetist for an initial evaluation. This evaluation is followed by a visit for measurement and impression-taking; then, after several fittings and some fine-tuning, the prosthesis is ready to be delivered to the amputee [19]. As we are focusing on how to ensure that the prosthesis, upon delivery, is optimally designed for the amputee, we will assess the beginning of the design process—the initial evaluation.

During this evaluation, the prosthetist works with the amputee to identify her needs, concerns, and goals for using a prosthesis [20]. This discussion involves many aspects of the amputee's life, including her lifestyle, career, hobbies, and plans [19], giving the prosthetist a general understanding of the amputee's priorities and her expectations for the prosthesis. This meeting also helps the prosthetist understand how frequently the amputee plans to use her prosthesis and identify any specific needs that will need to be addressed in the prosthesis' design. Along with this information, the prosthetist gathers the amputee's clinical information such as her age, activity level, skin integrity, pain, gait analysis, health markers based on diagnoses from her doctor, and assessments of strength and capabilities from her clinic team [21, 22]. This initial evaluation is a critical time for the amputee and her prosthetist [23]—the results of this evaluation will be the primary guide of the design decisions made to develop a prosthesis that will appropriately meet the amputee's needs.²

² An example of a lower prosthesis evaluation form is available in Appendix A.

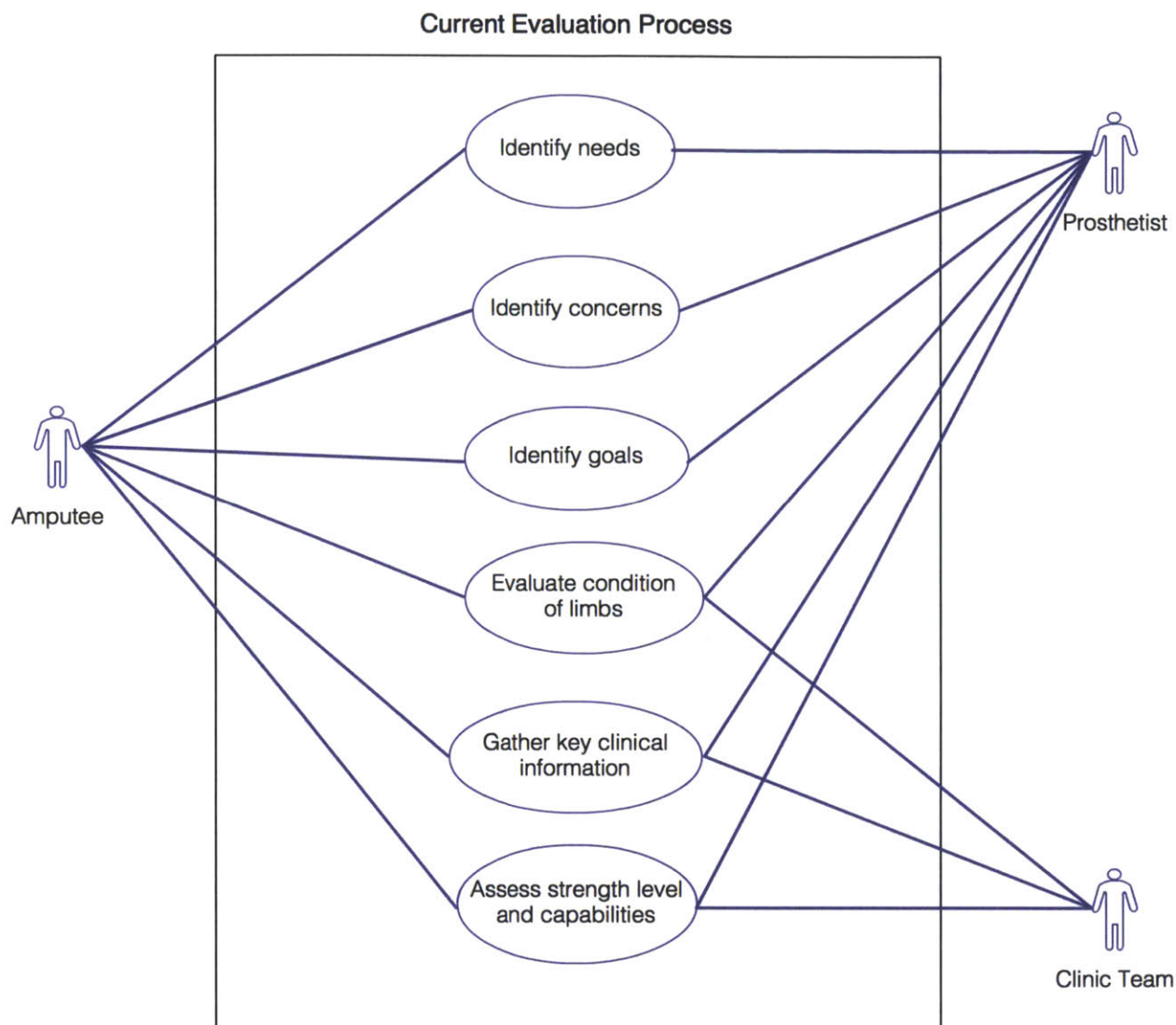


Figure 2: Map of Interactions Involved in Initial Evaluation

Note in Figure 2 that, due to their personal nature, the identification of needs, concerns, and goals occurs strictly between the amputee and the prosthetist. These needs, concerns, and goals are unique to the amputee, connected to her identity and body image. It is during these interactions that the amputee has the opportunity to paint a vivid and accurate picture of her life and personality. These conversations are the amputee's chance to share with the prosthetist the woman that she is. The better the prosthetist understands the amputee, the more optimal the prosthesis design.

Needs Identification Shortfall

Prosthetists do a phenomenal job working with amputees to determine their functional needs and designing prostheses to help them obtain their desired functionality, but often there is a lack of consideration for aesthetic needs in the design process. Currently, the aesthetics of prostheses are considered post-delivery, with many third parties like Bespoke Innovations and Fred's Legs providing solutions to customize existing prosthetic legs [24, 25].

Aesthetic restoration is often deemed unnecessary in the eyes of insurance carriers because they don't understand that appearance is important to every amputee [26]—it is a vital function of the prosthesis. Just as standing, walking, holding, and balance are important to the amputee, so are aesthetics. Traditional needs identification in the evaluation process is largely unsympathetic to aesthetic concerns. When an amputee meets with her prosthetist to discuss her needs for prosthesis use, the discussion will be centered on functionality and how the prosthesis will affect her normal daily activities, with no regard to the importance of her body image and how the prosthesis will affect her feminine identity.

The issue here is that an amputee who is focusing on a healthy recovery and coping with limb loss will have little to no time to be concerned about the aesthetics of her prosthesis. It is not until she has comfortably returned to her normal daily activities that she becomes concerned with how her prosthesis makes her look and feel. Unless the amputee herself brings up her aesthetic needs during her evaluation or throughout the process of obtaining her prosthesis, they will remain unaddressed [21] and she will own a prosthesis that fails to address any of those needs. For this reason, we

determine the needs identification process to be inadequate, especially for female amputees who are concerned with maintaining a healthy body image and feminine identity.

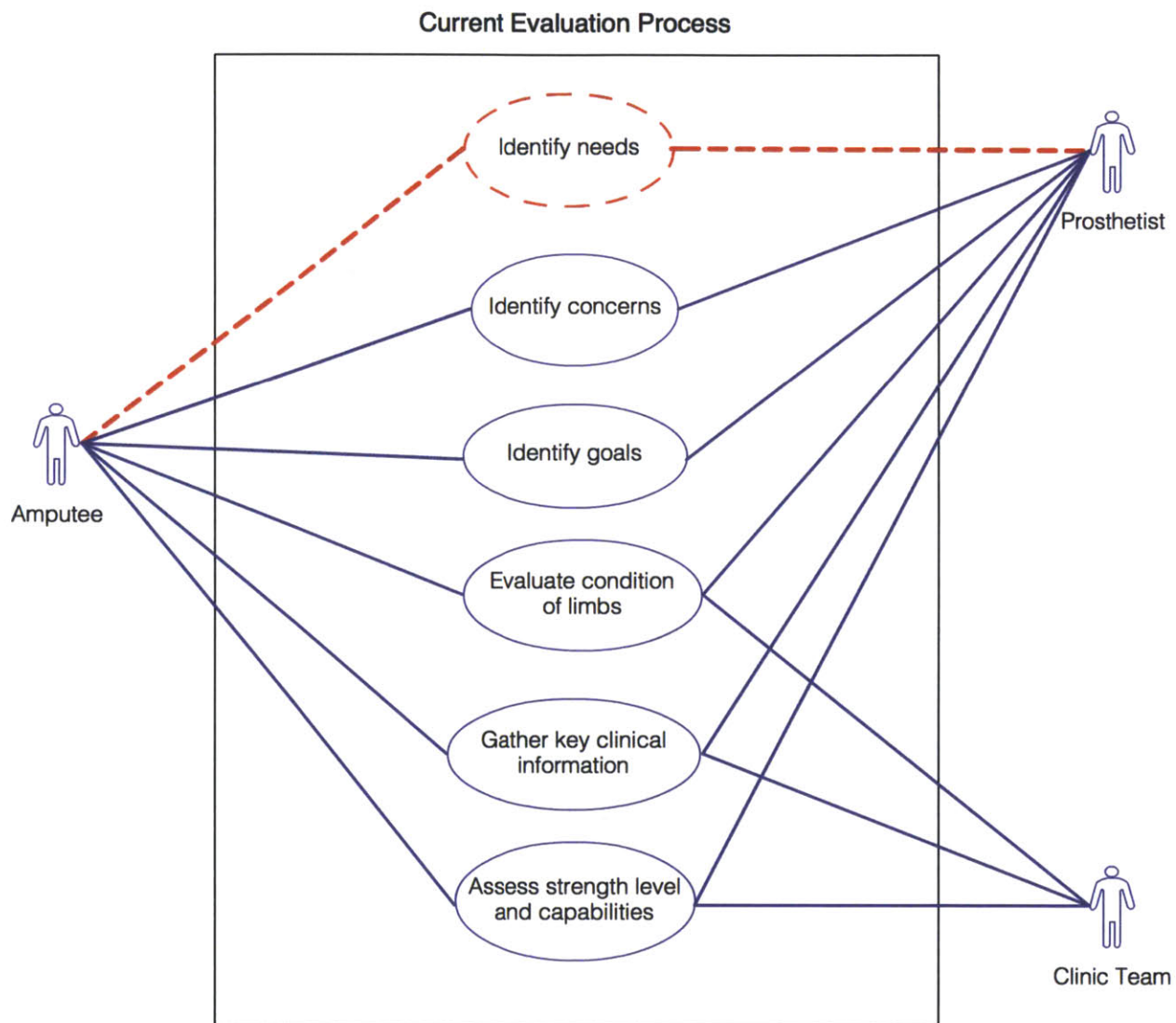


Figure 3: Insufficient Needs Identification

Gathering a well-rounded perspective of the amputee's body image and feminine identity during the 'Identify needs' phase, highlighted in Figure 3, will help to identify latent needs that will need to be met in order for optimal prosthesis satisfaction. In order to design a successful prosthesis, one that fully aligns with the amputee's needs, one should take into consideration all aspects of her life, from activities in her life that

require certain functionalities to her unique body image and identity that require certain aesthetics. This requires that the prosthetist, when asking the amputee about her needs during the evaluation, focus on both the physical aspects of the amputee, such as her lifestyle and career, and the psychological aspects, such as her body image.

Chapter 4

Identifying Latent Needs

The prosthesis design process currently does not take into account the psychological aspects of prosthesis use on female amputees, making it difficult for these amputees to receive their optimal prosthesis. As discussed in Chapter 2, it is important to many female amputees to continue expressing their feminine identity in all aspects of their lives post-amputation. However, it can become difficult for these amputees to maintain a healthy body image because prostheses are traditionally designed to provide function and not form. These aesthetic needs of the female amputee to have a feminine form and appearance while remaining just as functional are primarily psychological needs; left unattended, these needs can become a cause for the amputee's poor body image, putting her at risk for a decreased satisfaction in life and quality of living, among other things [12].

In his model of customer satisfaction, Kano [27] categorizes three different types of product requirements that are derived from user's needs: must-be requirements, one-dimensional requirements, and attractive requirements. Must-be requirements are derived from implied needs and lead to an extreme level of dissatisfaction if they are not fulfilled. However, because must-be requirements are the basic criteria of a product, they are taken for granted and their fulfillment leads only to a neutral state of "not dissatisfied". One-dimensional requirements are derived from the explicit needs of the user. The level of fulfillment of explicit physical needs in prosthesis design is proportional to the amputee's level of satisfaction with the prosthesis—the amputee is more satisfied with the prosthesis the more her explicit physical needs are fulfilled. Attractive requirements are derived from the amputee's latent needs and have the

greatest influence on the level of satisfaction. Fulfillment of these requirements leads to the greatest satisfaction of all because it addresses needs that are neither explicitly expressed nor expected by the amputee. Figure 4 is a visual representation of Kano's model.

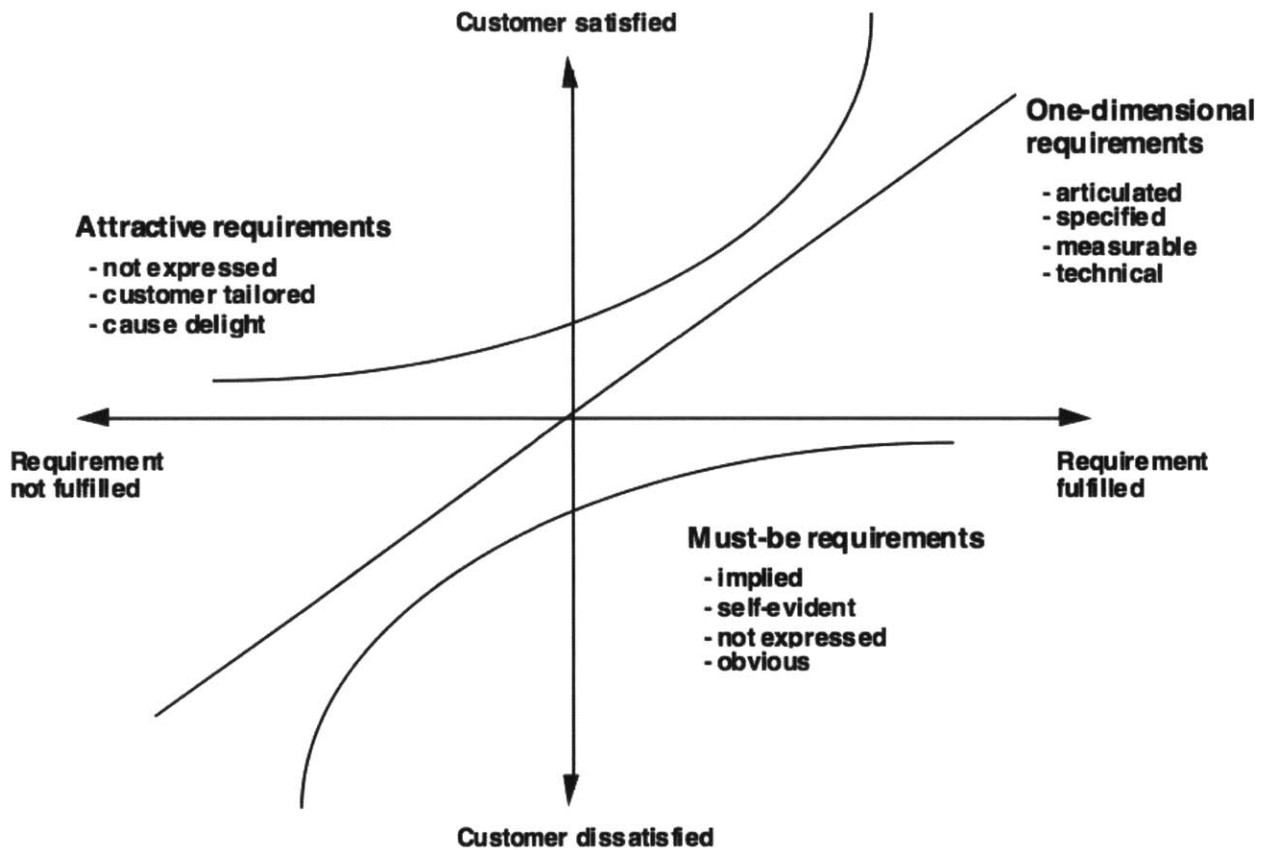


Figure 4: Kano's Model of Customer Satisfaction [27]

The aesthetic needs of female amputees, therefore, can be considered the latent needs of female amputees, as they are recognized by the amputee as important in the delivered prosthesis but are often not articulated in advance and thus not factored into the design. Latent needs are crucial in determining the amputee's satisfaction, sometimes even more so than explicit physical needs [28], as was seen in the case of the amputee who never got to wear her lovely two-piece suits [8]. These latent needs require consideration in the initial evaluation between an amputee and her prosthetist. Discussing their importance and impact on the amputee's life will help the prosthetist

make more informed prosthesis design decisions, thus leading to a more satisfying prosthesis for the amputee.

To identify areas where latent needs exist for female amputees, we will construct several use case diagrams that are specific to the female gender. Because clothing is an important tool for females to express their femininity [8], we will first identify typical items in a female’s wardrobe, followed by highlighting areas that are affected by limb loss. In these highlighted areas lie the opportunities for latent need identification; it is crucial to identify these needs during the initial evaluation between the prosthetist and the amputee so that they can be addressed during the design process. Figure 5 demonstrates clothing options a female has to express her identity.

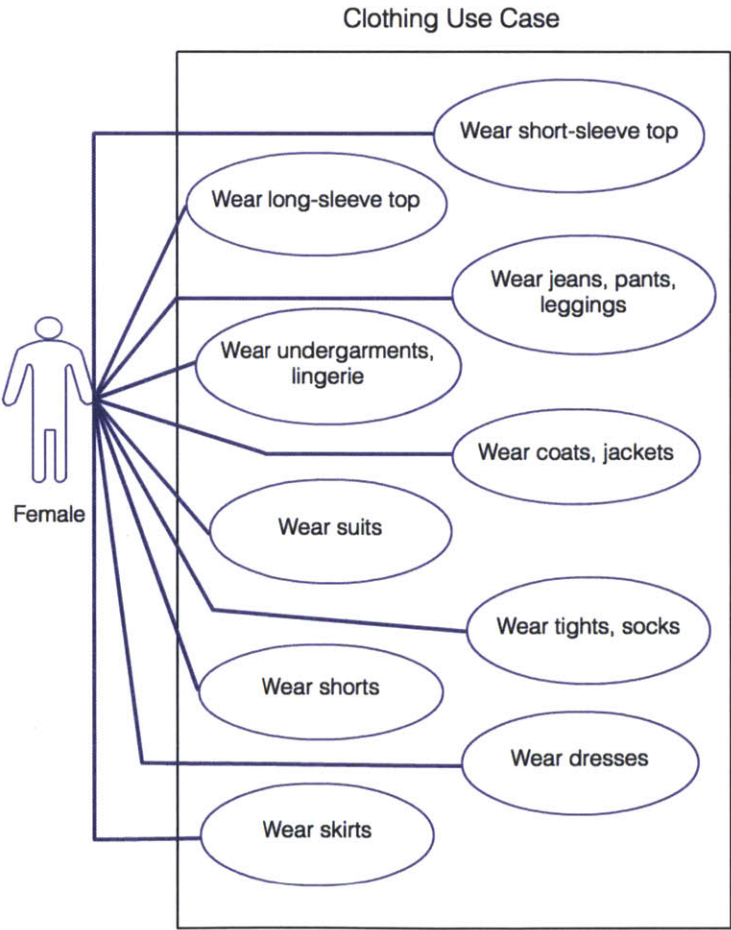


Figure 5: The Feminine Wardrobe: Clothing

To ensure that we address all areas where feminine latent needs may exist, we take into account the different parts of a female's full aesthetic expression of her femininity. In addition to clothing, women also express their femininity through accessories and shoes. Figures 6 and 7 demonstrate all the ways in which a female can use accessories and shoes to express her femininity.

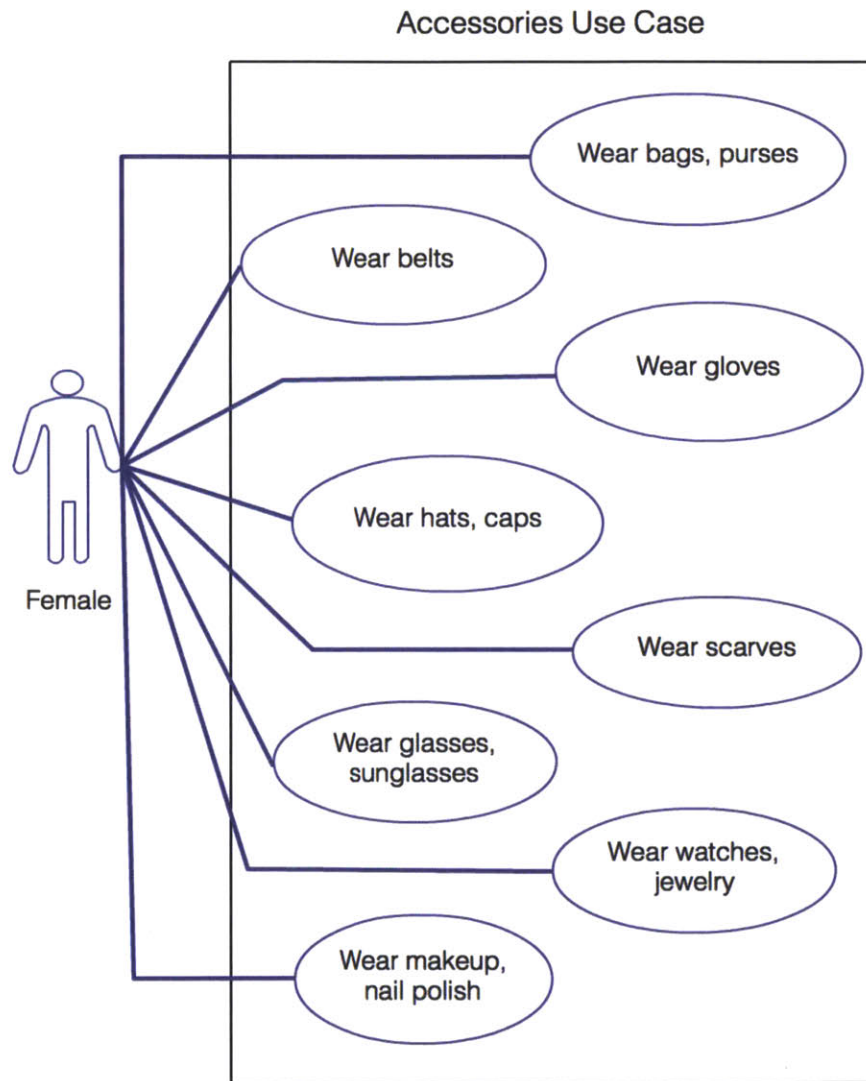


Figure 6: The Feminine Wardrobe: Accessories

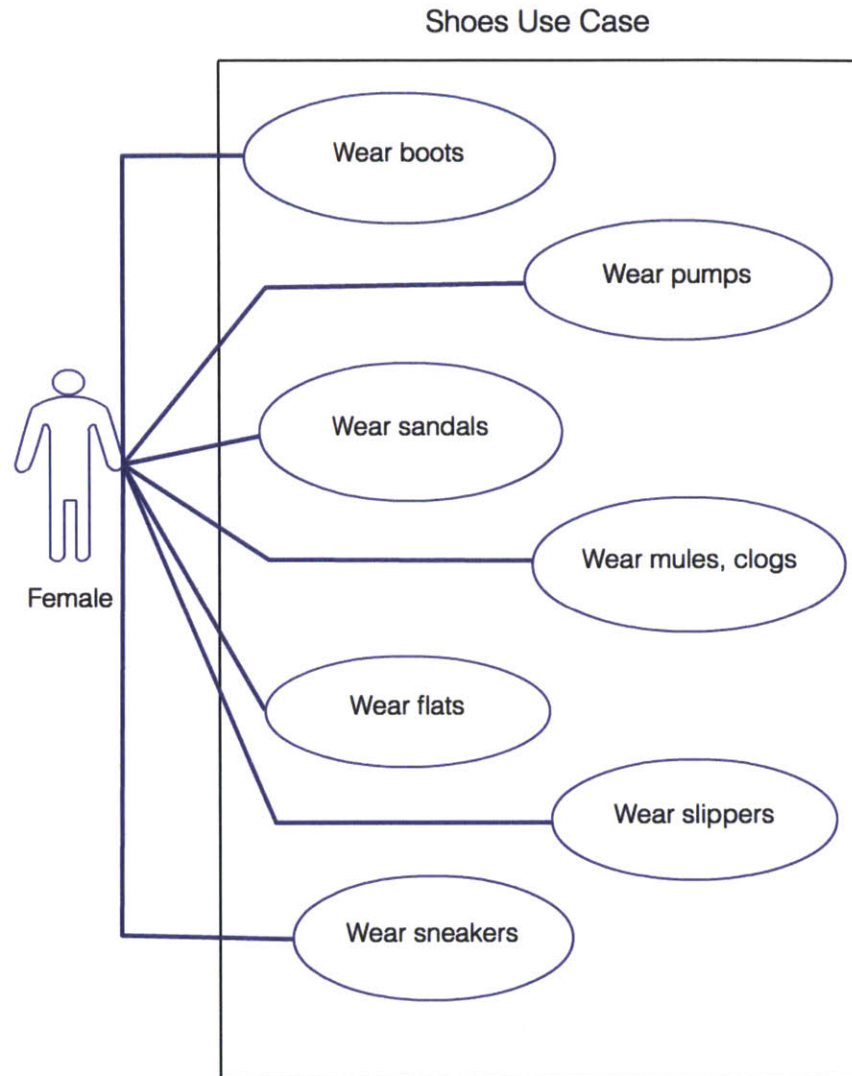


Figure 7: The Feminine Wardrobe: Shoes

Upper Extremity Case

There are different levels of upper extremity amputations, including fingers or partial hand (transcarpal), at the wrist (wrist disarticulation), below the elbow (transradial), at the elbow (elbow disarticulation), above the elbow (transhumeral), at the shoulder (shoulder disarticulation), and above the shoulder (forequarter) [29]. Each level of amputation affects different areas of the amputee's life; however, for the purpose of

identifying key areas where latent needs may exist in the given use cases, we will consider the highest level of amputation, the forequarter amputation, in our analysis. This will allow us to detect all possible areas that are affected by upper extremity amputations, and will only help female amputees and their prosthetists have a more thorough conversation about what latent needs may exist in their individual situations. The following diagrams identify the areas affected by upper extremity amputations.

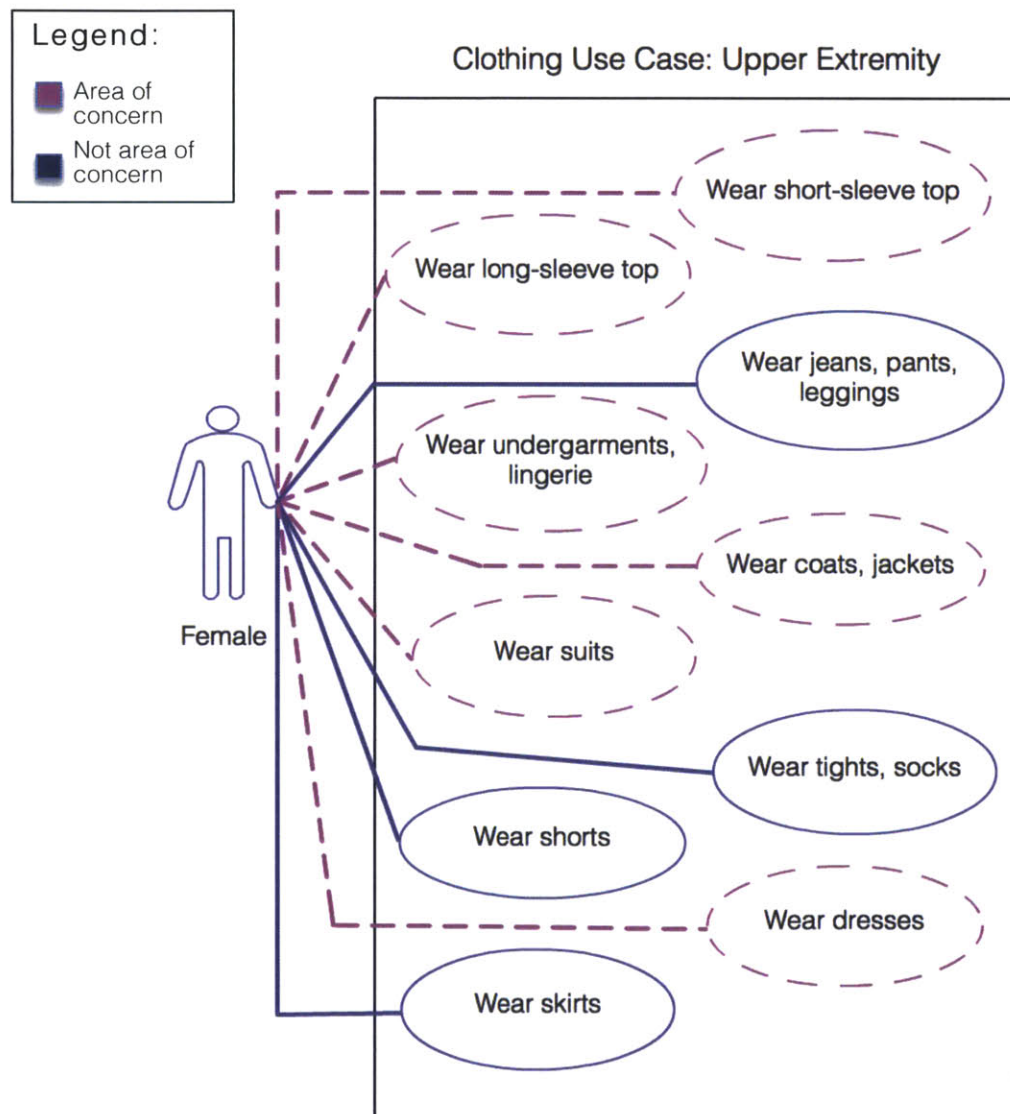


Figure 8: Upper Extremity: Clothing Use Case

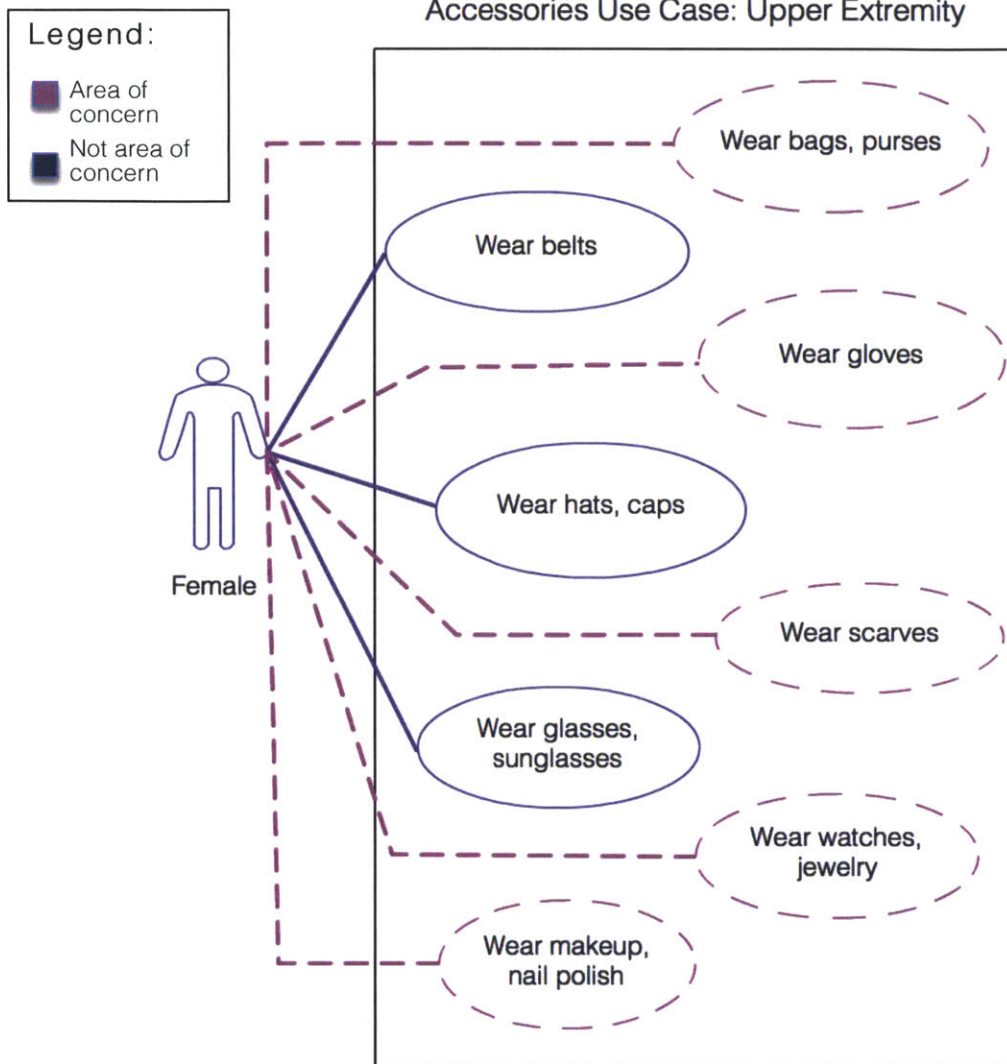


Figure 9: Upper Extremity: Accessories Use Case

An upper extremity amputation impacts a large portion of the feminine identity. When meeting with an amputee to discuss her needs, these use cases, however personal they may be, need to be addressed in order to understand what goals the amputee has for her prosthesis use beyond the functional capabilities. If we are to design a prosthesis for an amputee with a forequarter amputation, in addition to her physical and rehabilitation needs, we need to consider what clothes she wants to wear and how she wants to look and feel in them. We need to consider how her undergarments will

affect her prosthesis and perhaps decide to design her prosthesis to work with her undergarments. If our amputee is a regular at the nail salon, then we need to find ways to incorporate the use of nail polish into our prosthesis design. If there is a jewelry item of sentimental value to the amputee, we want to design her prosthesis in a way that showcases the item and makes her proud to wear both the item and the prosthesis that was so carefully designed with her identity in mind. Although it can be observed in Figure 10 that an upper extremity does not necessarily impact any shoe use cases, it's important to consider how the amputee will put and take off her shoes of choice.

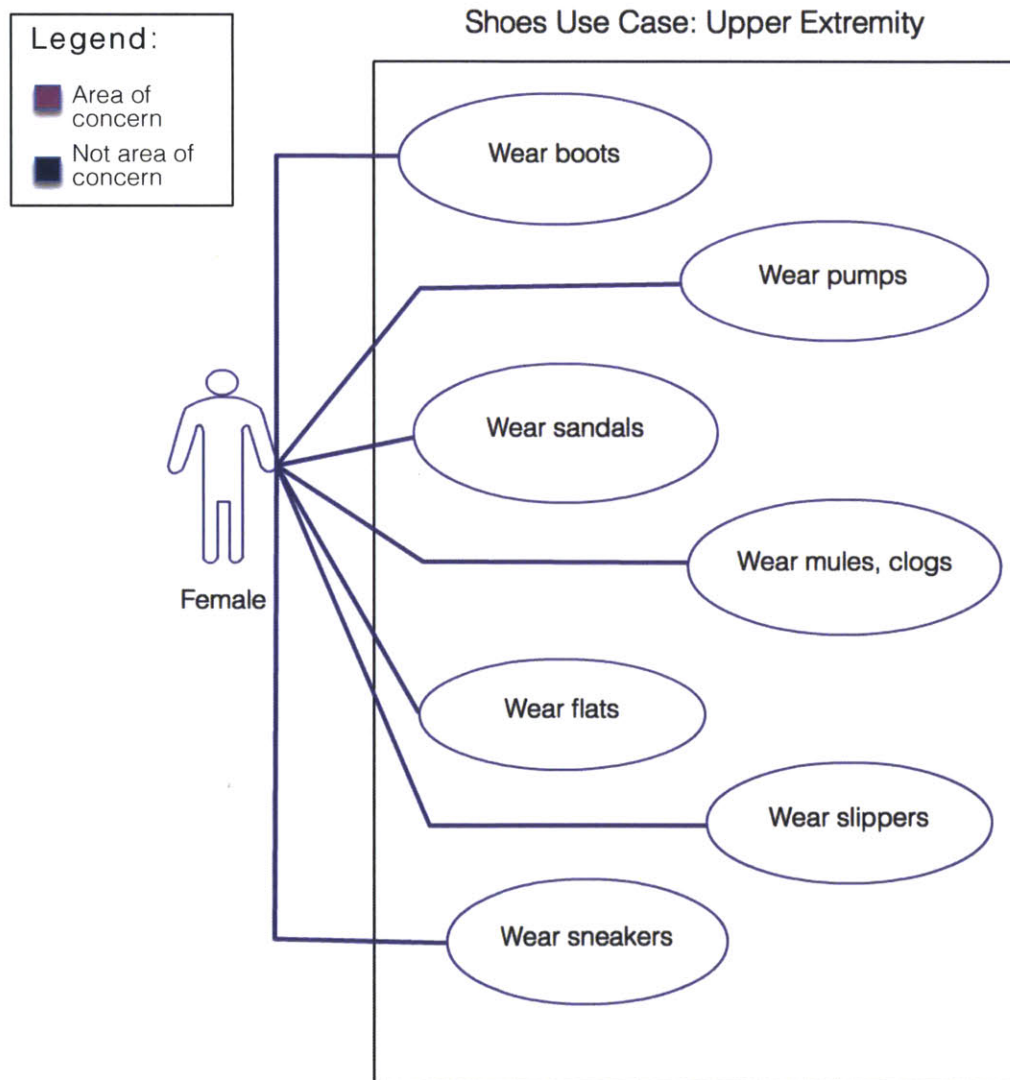


Figure 10: Upper Extremity: Shoes Use Case

Lower Extremity Case

There are different levels of lower extremity amputations, including foot (including toes or partial foot), at the ankle (ankle disarticulation), below the knee (transtibial), at the knee (knee disarticulation), above the knee (transfemoral), at the hip (hip disarticulation) [29]. For the purpose of our analysis, we will consider the hip disarticulation so as to identify all the possible areas of the feminine identity that may be impacted by a lower extremity amputation. The following diagrams identify areas affected by lower extremity amputations in the clothing and accessories use cases.

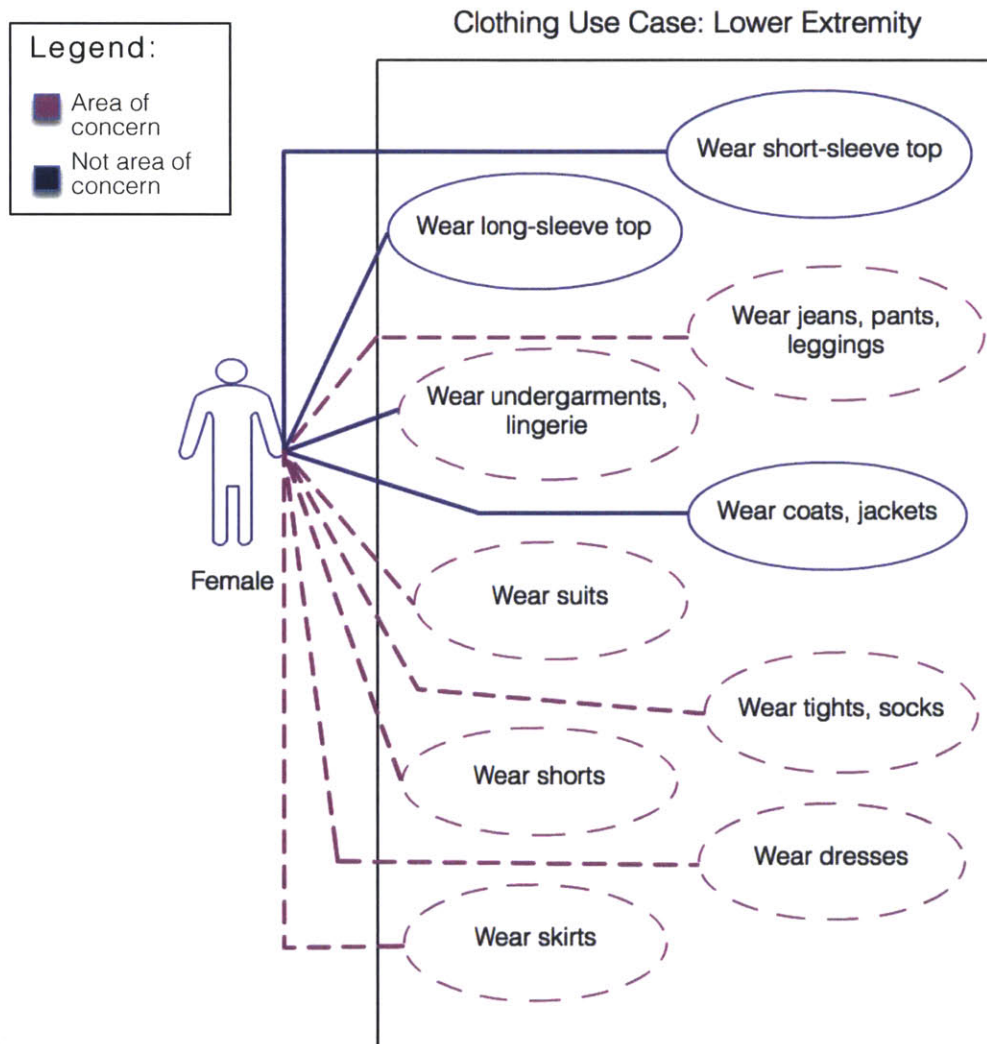


Figure 11: Lower Extremity: Clothing Use Case

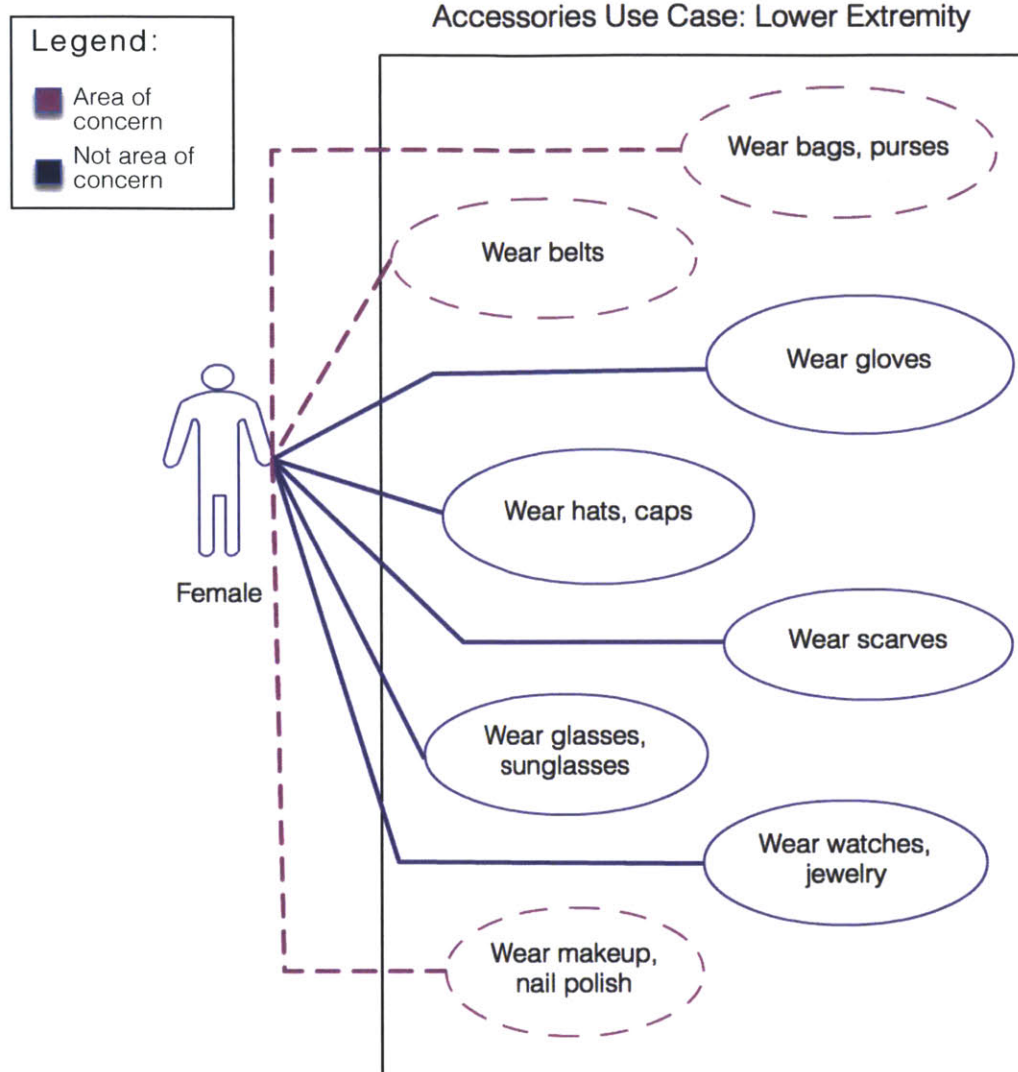


Figure 12: Lower Extremity: Accessories Use Case

A lower extremity amputation impacts an even larger portion of the feminine identity, and therefore it is especially important during the initial evaluation with the amputee to understand her unique body image and the feminine characteristics she identifies with. Unlike in the shoes use case of an upper extremity amputation, those with a lower extremity amputation have a very different situation—all of their options are impacted.

A female amputee with a lower extremity amputation does not desire any less to wear the magnificent shoes designed specifically for women. Different shoes go with different outfits. For women, shoes can change your posture, your height, and the way you carry yourself. In the evaluation with the amputee, then, it's important to understand her interactions with shoes—does she want to be able to wear high heels, boots, or sandals? Each shoe option has a different aesthetic and feel. In designing a successful lower extremity prosthesis for a female amputee, we have to understand things like what type of clothing she desires to wear, what activities she wants to perform, and what types of shoes fit her personality and lifestyle best.

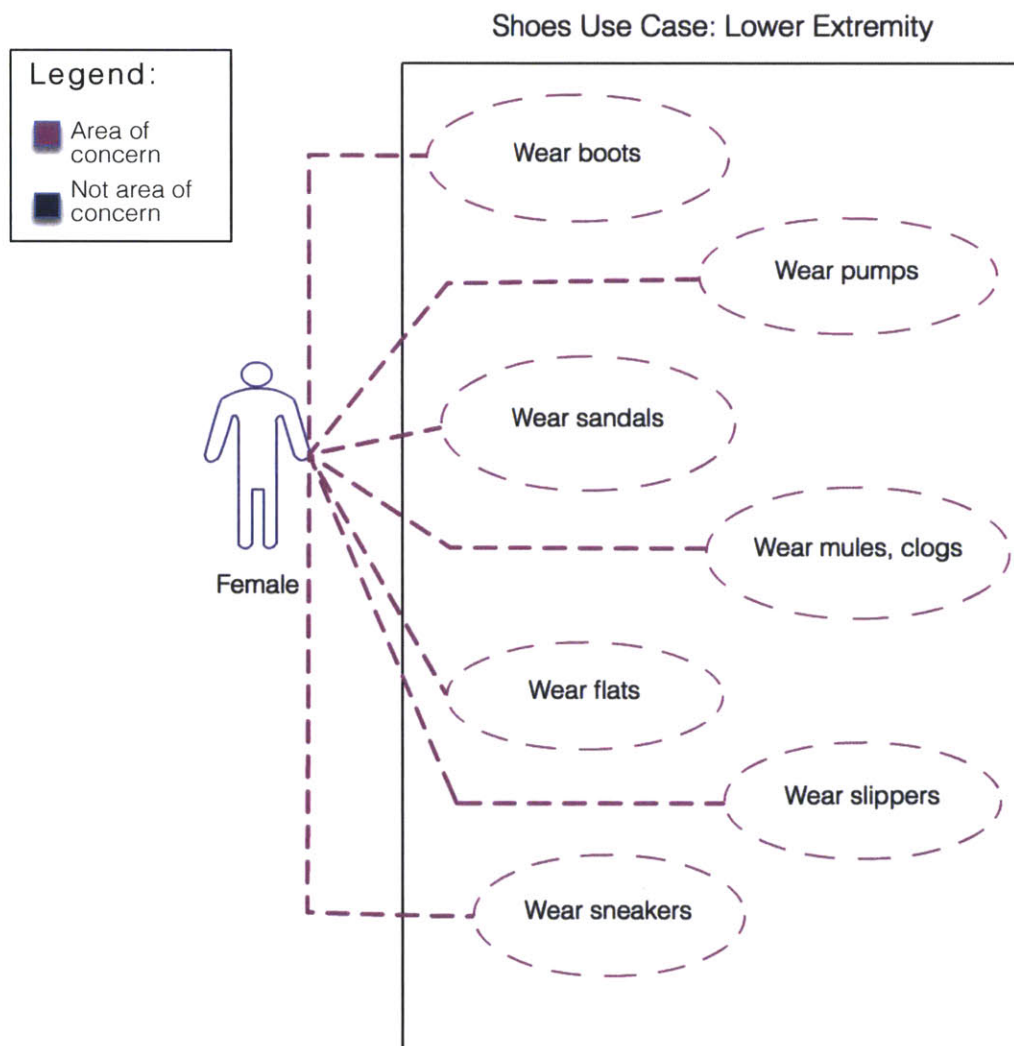


Figure 13: Lower Extremity: Shoes Use Case

A New Approach

The bottom line is that a prosthesis will always not match up to what the patient had before. Realistic expectations are as important as feedback to and from patient and prosthetist, as well as excellent prosthetic design and fit. We should never stop trying to attain perfection, but perfection will be different for each patient.

-Paul Armstrong, Hanger Clinic, Practice Manager and Market Fabrication Manager [30]

Designing for female amputees is a challenge, particularly because in a world that constantly stresses perfection on all fronts, it is difficult to meet unrealistic goals. However, we live in an age where we are surrounded generously by great knowledge and wisdom with new technologies and perspectives. Utilizing these tools to provide the most optimal prosthesis possible for an amputee is a rewarding feat. The most important aspect of design is communication—by exploring with the amputee who she is and where she wants to go, we can help design the best way for her to get there.

Using the three presented use case diagrams to understand areas where possible latent needs may exist, prosthetists can guide a portion of the initial evaluation into a deeper, more personal, territory, as the prosthesis is to soon become a part of the person and therefore it is rather crucial to get personal from the very beginning. During an initial evaluation with the female amputee, the prosthetist may present these use case diagrams to the amputee and discuss areas of her personal life that will be affected with the use of a prosthesis. This would help the prosthetist gain a better understanding of the feminine characteristic that the amputee identifies with, ideally leading to the identification of her latent needs early in the design process. Through

this communication, the amputee will also be better able to understand how her prosthesis will affect her life and, given her active participation, her unique inputs can help drive the design of her prosthesis in the right direction.

Chapter 5

Conclusion

Her legs have a beauty of their own, not just as objects, but also in relation to her body and posture. Many attributes of even a functional prosthesis affect the image its wearer will project—implications that may not even be treated as conscious design decisions. But they could be, and designers could play a valuable role.

- Graham Pullin, *Design Meets Disability* [9]

Amputations can be life-changing—they disrupt the habits we have developed over the years and they present challenges we may not have realized existed before. They can also give us the opportunity to pay attention to our selves and way of life, and to acknowledge our strength, courage, determination, and willpower. An amputation no longer has to stand for loss but instead as an opportunity to gain meaningful insight on who we are, what we want for our lives, and how we are going to get to where we want to be. We are all architects of our own lives. Through our goals, we develop a life rich with experience, marked by triumphs and hard lessons.

This thesis has explored the psychological effects of amputation on a female's body image and feminine identity, gaining insight on how the aesthetics and form of a prosthesis has a profound impact on the body image and thus quality of life of a female amputee. A discussion of initial prosthesis evaluation methods finds that these methods are unable to accurately capture and understand the latent, aesthetic needs of a female amputee, which can lead to a design that contributes to issues of poor body image and lower levels of life satisfaction. The identification of these latent needs

is a critical component of requirements development in the prosthesis design process; it can lead to a more appropriate design that aligns aesthetically with the amputee's body image and feminine identity. Key use case diagrams are developed in this thesis to define the scope of a female's interactions with some of the most crucial components in her expression of feminine identity—the items in her wardrobe. Through these use case diagrams, the areas of identity most affected by a particular amputation can be identified, allowing prosthetists to more easily identify latent, aesthetic needs to be addressed in the process of designing prostheses for female amputees.

Moving Forward

To design a more suitable female-gendered prosthesis, it would be helpful for prosthetists to use the use case diagrams presented in this thesis during the initial prosthesis evaluation with female amputees. It would be most appropriate to involve the diagrams during the discussion of the amputee's lifestyle to gain an understanding of how important a role aesthetics and form should play in the design of her prosthesis. For example, if the evaluation is for a lower extremity amputation, the prosthetist may share with the amputee the Lower Extremity Use Case diagrams and discuss the highlighted areas of her feminine identity that are most affected as a result of her amputation. From this discussion, the prosthetist can identify with the amputee any latent needs related to her body image and feminine identity and proceed to develop a prosthesis that most appropriately addresses those needs along with other identified explicit and latent needs.

These use case diagrams are designed to be an initial familiarization with the feminine identity and to get the prosthesis community active in exploring the impacts of different

prosthetic options from an aesthetics perspective and developing universal methods to address these latent, aesthetic needs in the design of future female-gendered prostheses. It would be useful to apply these diagrams during the prosthesis evaluation process for different groups of female amputees to better understand the how effects of amputation on body image and feminine identity vary for amputees of different ages and backgrounds. Conducted alongside a similar group of female amputees without use of the diagrams during the evaluation process, the usefulness of this approach to identify feminine latent needs can be clinically validated. If this approach proves to be successful in identifying the latent, aesthetic needs of female amputees and leads to better prosthesis design, an expansion of use case diagrams can be developed to identify other latent needs of both male and female amputees to improve overall prosthesis design.

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Appendix A

The following five pages are an example of a typical prosthesis evaluation for a lower extremity amputation:

LOWER LIMB PROSTHESIS EVALUATION FORM	
PATIENT INFORMATION	
Name: _____	DOB: _____ Ht. _____ Wt. _____ Age: _____ Sex: _____
New patient: <input type="checkbox"/> Yes <input type="checkbox"/> No For new amputee: has expressed desire to ambulate: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Date of amputation: _____ Side: _____	
Evaluation done at: <input type="checkbox"/> Office _____ <input type="checkbox"/> Hospital (name) _____	
<input type="checkbox"/> SNF (name) _____ <input type="checkbox"/> Home	
Referring physician name/phone: _____	
DIAGNOSIS	
ICD-9 Amputation Level (Traumatic Amputations)	
895.0 <input type="checkbox"/> Toe	897.2 <input type="checkbox"/> Trans-Femoral
896.0 <input type="checkbox"/> Partial Foot	897.4 <input type="checkbox"/> Hip Disarticulation
896.0 <input type="checkbox"/> Ankle Disarticulation	897.4 <input type="checkbox"/> Pelvic Disarticulation
897.0 <input type="checkbox"/> Trans-Tibial	897.4 <input type="checkbox"/> Not otherwise specified
897.2 <input type="checkbox"/> Knee Disarticulation	897.6 <input type="checkbox"/> Bilateral – any level
ICD-9 Amputation Level (Non-Traumatic Amputations)	
V49.71 <input type="checkbox"/> Toe	V49.75 <input type="checkbox"/> Below Knee Amputation
V49.72 <input type="checkbox"/> Other Toe(s)	V49.76 <input type="checkbox"/> Above Knee Amputation
V49.73 <input type="checkbox"/> Foot Amputation	V49.77 <input type="checkbox"/> Hip Amputation
V49.74 <input type="checkbox"/> Ankle Amputation	
PRIMARY MEDICAL DIAGNOSIS (CAUSE OF AMPUTATION) ICD-9 Code	
Other Medical Conditions: <input type="checkbox"/> Diabetes <input type="checkbox"/> Reduced pulmonary function <input type="checkbox"/> Cardiovascular disease <input type="checkbox"/> Arthritis	
<input type="checkbox"/> Peripheral vascular disease <input type="checkbox"/> Remaining foot requires medical attention <input type="checkbox"/> Peripheral neuropathy	
<input type="checkbox"/> Neoplasm, lower extremity, malignant- cancer <input type="checkbox"/> Gangrene <input type="checkbox"/> Other: _____	
Allergies: <input type="checkbox"/> None	
Cognitive abilities <input type="checkbox"/> Normal <input type="checkbox"/> Impaired/Explain: _____	
Prosthetic history and/or current problems to resolve: _____	
Condition of contralateral foot and treatment recommendations (If patient is diabetic and meets clinical need for foot care intervention, refer to Hanger Amputee Foot Care and Diabetic Shoe program. Utilize Foot Evaluation Form for Shoes and Inserts)	
<input type="checkbox"/> Normal <input type="checkbox"/> Patient is bilateral amputee <input type="checkbox"/> Impaired (Explain): _____	
Recommendation for: <input type="checkbox"/> Diabetic footwear- custom fit <input type="checkbox"/> Pressure formed insert <input type="checkbox"/> Direct heat formed insert	
<input type="checkbox"/> Diabetic footwear- custom fabricated <input type="checkbox"/> Custom fabricated insert	
Clinical indication(s):	
<input type="checkbox"/> Insert use for prevention/treatment of plantar ulcers <input type="checkbox"/> Footwear for accommodation of foot deformity	
<input type="checkbox"/> Footwear for accommodation of use of insert <input type="checkbox"/> Custom design indicated secondary to degree/severity of involvement	
<input type="checkbox"/> Other: _____	
Last physician visit <input type="checkbox"/> N/A Date _____ Physician Name/phone number: _____	
Last prosthetic service <input type="checkbox"/> N/A <input type="checkbox"/> Repair <input type="checkbox"/> Socket Replacement <input type="checkbox"/> New Prosthesis <input type="checkbox"/> Edema/Post surgical Treatment	
Date: _____ Provider (company and/or practitioner): _____	

Living status: <input type="checkbox"/> Alone or without assistance <input type="checkbox"/> Long-term care facility <input type="checkbox"/> Home with assistance	
<input type="checkbox"/> Other: _____	
Reason for amputation <input type="checkbox"/> Trauma <input type="checkbox"/> Diabetic <input type="checkbox"/> Tumor <input type="checkbox"/> Vascular <input type="checkbox"/> Congenital	
<input type="checkbox"/> Other/explain: _____	
Physical therapy <input type="checkbox"/> None <input type="checkbox"/> Ongoing <input type="checkbox"/> Needed/recommendation: _____	
Current assistive devices used: Handrails available at home Yes <input type="checkbox"/> No <input type="checkbox"/> Ramp available at home Yes <input type="checkbox"/> No <input type="checkbox"/>	
Ambulatory aids: None <input type="checkbox"/> Cane <input type="checkbox"/> Crutches <input type="checkbox"/> Walker <input type="checkbox"/> Wheelchair <input type="checkbox"/>	
Prosthesis longevity and patient wearing schedule <input type="checkbox"/> N/A Years wearing a prosthesis _____	
Age of current prosthesis _____ Hours worn/day _____	
Describe <i>design and</i> components of present prosthesis: <input type="checkbox"/> N/A	
Construction: <input type="checkbox"/> Endoskeletal <input type="checkbox"/> Exoskeletal	
Socket _____	
Knee _____	
Suspension _____	
Foot/Ankle _____	
Describe condition of present prosthesis, including components: <input type="checkbox"/> N/A	
Does present prosthesis meet patient's current needs? (Function, safety, etc): <input type="checkbox"/> N/A <input type="checkbox"/> Yes <input type="checkbox"/> No If no, explain: _____	
FUNCTIONAL LEVEL ASSESSMENT	
K0 The patient has no ability or potential to ambulate or transfer	
K1 Ability or potential to transfer or ambulate on level surfaces at fixed cadence	
K2 Ability or potential for ambulation with ability to traverse low level barriers	
K3 Ability or potential to ambulate with variable cadence; perform activities beyond simple locomotion	
K4 Ability or potential for activities including high impact, stress or energy levels	
Patient's CURRENT level: K _____ Patient's EXPECTED level: K _____	
Specify rationale if difference will exist between current and expected level: _____	
PATIENT'S EXISTING ENVIRONMENTAL BARRIERS (Check all that apply)	
<input type="checkbox"/> Level surfaces <input type="checkbox"/> Level with steps <input type="checkbox"/> Uneven surfaces <input type="checkbox"/> Stairs <input type="checkbox"/> Ramps or slopes <input type="checkbox"/> Other/specify: _____	
VOCATIONAL ACTIVITIES TO SUBSTANTIATE PATIENT FUNCTIONAL LEVEL DESIGNATION <input type="checkbox"/> N/A	
REQUIRED: Detail the patient's current /expected types of vocational activity AND how they support the determination of the indicated functional level. (Include % of time seated, standing, and ambulating.)	
<input type="checkbox"/> None	
<input type="checkbox"/> Light duty/specify: _____	
<input type="checkbox"/> Moderate duty/specify: _____	
<input type="checkbox"/> Heavy duty/specify: _____	
PATIENT'S CURRENT OR EXPECTED TYPES OF ACTIVITIES	
<input type="checkbox"/> Walking <input type="checkbox"/> Running <input type="checkbox"/> Skiing <input type="checkbox"/> Hiking <input type="checkbox"/> Golf <input type="checkbox"/> Dancing <input type="checkbox"/> Weight training <input type="checkbox"/> Aerobics <input type="checkbox"/> Racquet sports	
<input type="checkbox"/> Hunting/Fishing <input type="checkbox"/> Driving <input type="checkbox"/> Household shopping <input type="checkbox"/> Physical transport of cargo <input type="checkbox"/> Use of ladder or similar item	
<input type="checkbox"/> Other: _____	
<input type="checkbox"/> Ambulation distance average per day: <input type="checkbox"/> Less than 1 block <input type="checkbox"/> 1-3 blocks <input type="checkbox"/> ½ mile <input type="checkbox"/> 1 mile <input type="checkbox"/> 1-2 miles <input type="checkbox"/> > 2 miles	
REQUIRED: Detail how the patient's day-to-day activities substantiate the functional level designation, taking into consideration the physical barriers they encounter, repetition of actions, speed of motion, energy/stress required to complete the activities, use/lack of use of ancillary supports, etc.(How do the activities differentiate from one K level to another):	

STRENGTH/RANGE OF MOTION												
	Left Side <input type="checkbox"/>						Right Side <input type="checkbox"/>					
	Zero	Trace	Poor	Fair	Good	Norm	Zero	Trace	Poor	Fair	Good	Norm
	0	1	2	3	4	5	0	1	2	3	4	5
Strength												
Ankle												
Dorsiflexion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plantarflexion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inversion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eversion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Knee												
Flexion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hip												
Flexion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Abduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internal Rot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
External Rot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contracture	No Yes Amount						No Yes Amount					
Ankle	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>				
Knee	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>				
Hip	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>				
Hand and finger dexterity	Normal Impaired						Normal Impaired					
	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>				
RESIDUAL LIMB CHARACTERISTICS												
Length (state inches or centimeters) _____						Tissue Consistency: <input type="checkbox"/> Soft <input type="checkbox"/> Medium <input type="checkbox"/> Firm						
Explanation/Additional Comments:												
Invagination	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Bulbous	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Discoloration	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Scarring	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Delayed healing	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Drainage	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Neuroma	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
Bony prominences	Yes <input type="checkbox"/>	No <input type="checkbox"/>	_____									
PROSTHETIC SERVICE RECOMMENDATIONS												
Type of prosthesis required <input type="checkbox"/> HP <input type="checkbox"/> HD <input type="checkbox"/> AK <input type="checkbox"/> TK <input type="checkbox"/> BK <input type="checkbox"/> Symes <input type="checkbox"/> Partial Foot												
<input type="checkbox"/> IPOP <input type="checkbox"/> EPOP <input type="checkbox"/> Preparatory/Temporary <input type="checkbox"/> Definitive <input type="checkbox"/> Other: _____												
Diagnostic socket(s) required: <input type="checkbox"/> Yes <input type="checkbox"/> No Number of socket(s) anticipated: _____												

Use of diagnostic socket(s) necessary to evaluate/treat: ☐ N/A ☐ Suction suspension ☐ Unusual muscle contour/suture lines

☐ Scarring ☐ Fragile skin ☐ Other: _____

Describe socket design to be provided, including materials (check all that apply): ☐ N/A

☐ Suction ☐ Total contact ☐ Flexible w/rigid frame ☐ Laminated ☐ Thermoplastic ☐ IC/Narrow M-L
☐ Cushion (Air, fluid, gel) ☐ Acrylic ☐ PTB ☐ PTSC ☐ Vacuum system ☐ Comfort Flex

☐ Other: _____

How will socket design and material functionally benefit this patient (check all that apply): ☐ N/A

☐ Improve suspension ☐ Optimum pressure distribution ☐ Proximal tissue containment ☐ Reduction of prosthesis weight
☐ Increase socket strength ☐ Accommodate anatomical anomalies ☐ Increase M/L stability
☐ Donning/doffing assistance ☐ Improve proprioception ☐ Increase weight bearing

☐ Other: _____

Describe suspension/interface proposed for this patient (check all that apply): ☐ N/A

☐ Silicone or equal insert, locking ☐ Prefabricated ☐ Custom
☐ Silicone or equal insert, non-locking ☐ Prefabricated ☐ Custom

Rationale for custom design: _____

☐ Locking pin or equal ☐ Multi-durometer insert ☐ Distal cushion ☐ Lacer or ☐ Joints and lacer
☐ Suction/sealing sleeve ☐ Knee sleeve ☐ Cuff/strap/belt suspension
☐ Socket insert (pelite, kemblo, aliplast, etc.) ☐ Supracondylar/anatomical

☐ Other: _____

Describe how the suspension/interface will functionally benefit this patient (check all that apply): ☐ N/A

☐ Accommodate fragile skin ☐ Increased prosthetic suspension ☐ Decrease in limb pistoning ☐ Increased anatomical joint stability
☐ Distal limb pressure reduction ☐ Reduction in tissue shear forces ☐ Accommodate bony prominences

☐ Other: _____

Describe the foot design proposed for this patient ☐ N/A

☐ External Keel, SACH (K1-4) ☐ Flexible Keel (K2-4) ☐ Single Axis ankle/foot (K1-4) ☐ Energy storing (K3-4)
☐ Multi-axial ankle foot (2-4) ☐ Flex foot system (K3-4) ☐ Flex walk or equal (K3-4)
☐ Dynamic response, one piece (K3-4) ☐ Shank foot system with vertical load pylon (K3-4) ☐ SACH (basic)

☐ Other: _____

How will this foot functionally benefit this patient? ☐ N/A ☐ Walk on uneven ground ☐ Walk farther with reduced weight
☐ Optimize functional energy capability for functional level actions ☐ Provide for increased activity level ☐ Bilateral considerations

☐ Other: _____

Is a vertical loading/shock reducing pylon indicated for this patient? ☐ No ☐ Yes (explain): ☐ Reduce impact at heel strike
☐ Increase shock absorption ☐ Increase energy efficient gait ☐ Reduce skin shear ☐ Perform high stress activities

☐ Other: _____

Is an adjustable foot heel height feature indicated for this patient? ☐ No ☐ Yes/Explain: _____

☐ Cosmetic purposes: _____

☐ Functional purposes: _____

Is a flexible outer covering indicated for this patient? ☐ No ☐ Yes If yes, explain why: _____

☐ Moisture protection of components secondary to environmental factors (indicate factors): _____

☐ Other: _____

If a prosthetic knee is required, describe the type of knee indicated for this patient: ☐ N/A

Manufacturer/style: _____

Classification and "K" level: _____

How will knee unit functionally benefit this patient? ☐ N/A ☐ Walk or run with appropriate knee response
☐ Have additional knee stability ☐ Walk farther as a result of using a lighter prosthesis ☐ Negotiate ramps or stairs
☐ Participate in high impact or strenuous activities ☐ Reduce trauma to contralateral limb

☐ Other: _____

Is an "ultralight" system (socket AND componentry) indicated for this patient? ☐ No ☐ Yes (explain): _____

☐ Reduced weight as part of medical condition ☐ Compensation for increased material strength needed for functional use

☐ Other: _____

Is an alignable system indicated for this patient? <input type="checkbox"/> No <input type="checkbox"/> Yes (explain): <input type="checkbox"/> Contracture management <input type="checkbox"/> Interchange components <input type="checkbox"/> Accommodate angular deformity <input type="checkbox"/> Provide for clinically indicated alignment changes <input type="checkbox"/> Other: _____	
Is a rotation unit indicated for this patient? <input type="checkbox"/> No <input type="checkbox"/> Yes Type: <input type="checkbox"/> Axial rotation <input type="checkbox"/> Multi-axial Clinical rationale: <input type="checkbox"/> Decreased skin shear <input type="checkbox"/> Activity requires increased axial rotation/torque absorption (Explain): <input type="checkbox"/> Other: _____	
If both types of units are indicated on patient, what is clinical rationale and location of units on prosthesis: <input type="checkbox"/> N/A	
Is a heavy duty feature indicated for this patient? <input type="checkbox"/> No <input type="checkbox"/> Yes Clinical rationale: <input type="checkbox"/> Patient weight (specify) _____ <input type="checkbox"/> Patient activity (specify) _____ <input type="checkbox"/> Other _____	
Is an auxiliary suspension system indicated for this patient? <input type="checkbox"/> No <input type="checkbox"/> Yes (explain): _____	
REPLACEMENT SERVICES (Check Box if Not Applicable <input type="checkbox"/>)	
Clinical rationale for replacement of socket and/or components (Check all that apply) (Do not complete when providing new prosthesis)	<input type="checkbox"/> Change in residual limb: Weight change +/- from initial delivery _____ Circumference change from initial delivery (2" increments) _____ <div style="display: flex; justify-content: space-around;"> Change in sock ply <div style="text-align: center;"> Initial Current </div> </div> <input type="checkbox"/> Multiple modifications have been made to socket to accommodate physical changes <input type="checkbox"/> Further socket modifications will not provide a satisfactory resolution of problem(s) <input type="checkbox"/> Componentry replacement (Specify type and reason for replacement) _____ <input type="checkbox"/> Cost of repairs would be more than 60% of the cost of a replacement <input type="checkbox"/> Change in functional level (Specify patient activity supporting the change): _____ <input type="checkbox"/> Irreparable damage (Specify type and extent): _____ <input type="checkbox"/> Normal wear and tear (Specify type and extent): _____
Describe how changes above will affect functioning of prosthesis <input type="checkbox"/> Increase risk of injury to patient <input type="checkbox"/> Premature wear of device/components <input type="checkbox"/> Increased energy expenditure <input type="checkbox"/> Limit intended optimum functional usage <input type="checkbox"/> Increase of pain/discomfort for patient <input type="checkbox"/> Increase risk of adverse skin pressure <input type="checkbox"/> Decrease in optimum fit of device <input type="checkbox"/> Other: _____	
Will the item be replaced with something other than that currently utilized? <input type="checkbox"/> No <input type="checkbox"/> Yes (If yes, explain why): _____	
Will this be a socket replacement only? <input type="checkbox"/> Yes <input type="checkbox"/> No (If no, explain why): _____	
Rationale for new alignable system if provided with socket replacement (Include all components provided with system/Must be multiple components to qualify as an alignable system) <input type="checkbox"/> N/A	
Did the patient tolerate the evaluation without incident/problem? <input type="checkbox"/> Yes <input type="checkbox"/> No (explain): _____	

Practitioner name (print): _____ Practitioner signature: _____

Date of evaluation: _____ Office: _____